
# Using GISS modelE

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## Climate In a Box Workshop

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# Outline

- Introduction to modelE
- Obtaining the code
- Installing modelE: code structure
- Running modelE
- Hands-on

# Introduction to modelE

- modelE is a climate model (atmosphere-ocean-sea-ice system) developed at the Goddard Institute for Space Studies (GISS).
- modelE emphasizes an improved physics (tracers, a more resolved stratosphere, cloud microphysics, etc.) over higher resolution.
- Available resolutions are $2^{o}$x$2.5^{o}$ and $4^{o}$x$5^{o}$ latitude by longitude.
- Standard vertical resolution is 20 vertical layers (0.1hPa top).


# Obtaining the code

- A version of modelE (8/10/2010 snapshot) is already installed and ready to run on the CIB system.
- For in-depth details on how to obtain different code bases and install the model from scratch consult the CIB User's Guide and/or
  - http://modelingguru.nasa.gov/docs/DOC-1755
- Generally, on non-NCCS systems contact Gavin Schmidt at:
  - http://www.giss.nasa.gov/staff/gschmidt.html


# Obtaining the code

- Once registered getting the code is really simple:

  *export CVSROOT=simplex.giss.nasa.gov:/giss/cvsroot*

  *export CVS_RSH=ssh*

  *cvs co modelE*

- This gets you the latest code snapshot.

# Configuration

- For modelE to work properly you have to create a configuration file .modelErc in your home directory

```
## Directory structure ##

# DECKS_REPOSITORY - a directory for permanenet storage of run info.
# All rundecks that you create will be copied to this directory.
DECKS_REPOSITORY=/home/ccruz2/final/modelEsa/decks

# CMRUNDIR - directory to which all run directories will be linked.
# This directory will be searched by most scripts for locations of
# specific runs.
CMRUNDIR=/home/ccruz2/final/modelEsa/cmrun

# EXECDIR - path to directory with modelE scripts and with some
# executables. This directory should contain the scripts from modelE/exec.
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# SAVEDISK - a directory where all run directories (which will contain
# all output files such as rsf, acc etc.) will be created. This should
# be big enough to accomodate all model output.
SAVEDISK=/home/ccruz2/final/modelEsa/out

# GCMSEARCHPATH - directory to search for gcm input files.
# All necessary input files should be copied or linked to this directory.
GCMSEARCHPATH=/cib/inputdata/modele

# NETCDFHOME - path to location of netcdf library. Leave blank if netcdf
# is not installed on this computer
NETCDFHOME=/cib/libraries/netcdf/3.6.2_intel11

## Customizable setings for Makefile ##

# OUTPUT_TO_FILES - if set to YES all errors and warnings will be sent
# to files with the names <source_name>.ERR
OUTPUT_TO_FILES=YES
```

```
# VERBOSE_OUTPUT - if set to YES gmake will show compilation commands
# and some other information. Otherwise most of the output will be
# suppressed
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# Compiler
COMPILER=intel

# MPI
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MPIDIR=/opt/mpi/mvapich2/1.5/intel-11.1/bin/..

# ESMF
ESMF=YES
ESMF_COMM=mpich2
ESMF_BOPT=O
ESMFINCLUDEDIR=/cib/libraries/esmf/2.2.2rp3_intel/Linux/mod
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# openMP
MP=NO
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Input data (BCs)

mkdir decks cmrun exec out

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Compiler and MPI

# Configuration

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modelE/config/compiler.intel.mk

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modelE/config/mpi.mvapich2.mk

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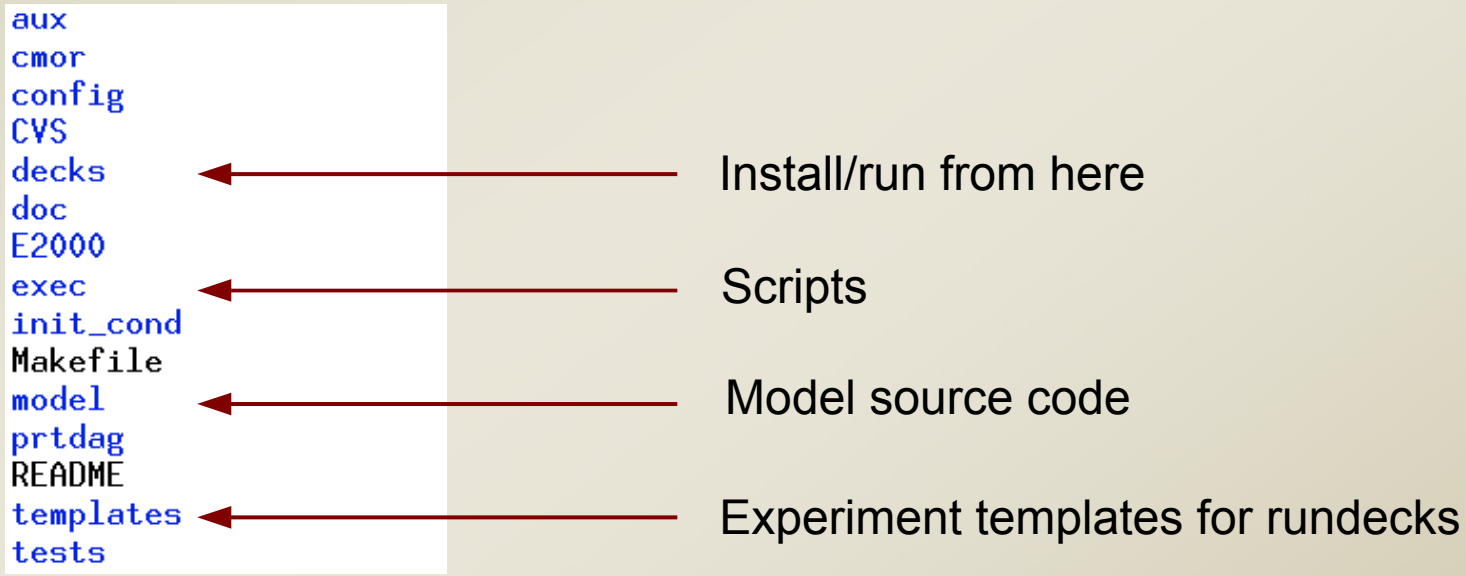
Prerequisites for a full installation

# Installing modelE: code structure

- Once you get the code you will notice that the code distribution has a top directory – modelE - which contains the following sub-directories:



# Installing modelE

*cd modelE/decks*

- Select a run deck

*gmake rundeck RUN=E1M20cib RUNSRC=E1M20*

RUNSRC specifies the run deck template

"gmake rundeck" creates a rundeck file E1M20cib.R

# Installing modelE

*cd modelE/decks*

- Select a run deck

  *gmake rundeck RUN=E1M20cib RUNSRC=E1M20*

- Build model

  *gmake gcm RUN=E1M20cib*

# "Setup" modelE

*cd modelE/decks*

- Select a run deck

  *gmake rundeck RUN=E1M20cib RUNSRC=E1M20*

- Build model

  *gmake gcm RUN=E1M20cib*

- Setup model

  *gmake setup RUN=E1M20cib NCPUS=16*

Assumes you are running interactively

# Running modelE

- For longer runs edit INPUTZ namelist in E1M20cib.R

```
&INPUTZ
   YEARI=1949,MONTHI=12,DATEI=1,HOURI=0, IYEAR1=1949 ! or earlier
   YEARE=1949,MONTHE=12,DATEE=2,HOURE=0,     KDIAG=13*0,
   ISTART=2,IRANDI=0, YEARE=1949,MONTHE=12,DATEE=1,HOURE=1,
 /
```

```
&INPUTZ
   YEARI=1949,MONTHI=12,DATEI=1,HOURI=0, IYEAR1=1949 ! or earlier
   YEARE=1954,MONTHE=12,DATEE=1,HOURE=0,     KDIAG=13*0,
 /
```

- Then re-run “gmake setup” or submit a “job”

# Rundecks

- Templates under modelE/templates
- Examples:
  - E1M20 = most basic rundeck

```
modelE 4x5 hor. grid with 20 lyrs, top at .1 mb (+ 3 rad.lyrs)
atmospheric composition from year 1850 (or 1979)      (look below for "_yr")  ?
ocean data: prescribed, 1876-1885 (or 1975-1984) climatology  (see OSST/SICE) ?
uses turbulence scheme, simple strat.drag (not grav.wave drag)
time steps: dynamics 7.5 min leap frog; physics 30 min.; radiation 2.5 hrs
filters:    U,V in E-W direction (after every dynamics time step)
            sea level pressure (after every physics time step)
```


# Rundecks

- Templates under modelE/templates
- Examples:
  - E1M20 = most basic rundeck
  - E1fvcM20: FV cubed-sphere
  - E4M20
  - etc...
- Dozens of templates
- Create your own

# CIB hands on

*cd /cib/outputdata/guest{X} where X=1...9*

*cp /cib/inputdata/archives/modelE.scratch.tgz .* ← Note the space followed by a dot


# CIB hands on

*cd /cib/outputdata/guest{X} where X=1...9*

*cp /cib/inputdata/archives/modelE.scratch.tgz .*

*tar xfz modelE.scratch.tgz*

*cd modelE.scratch*

# CIB hands on

*cd /cib/outputdata/guest{X} where X=1...9*

*cp /cib/inputdata/archives/modelE.scratch.tgz .*

*tar xfz modelE.scratch.tgz*

*cd modelE.scratch*

*cp /cib/models/archives/modele_env.bash .*

*. ./modele_env.bash* ← This script will set the module environment

Note the space followed by a dot

# CIB hands on

*cd /cib/outputdata/guest{X} where X=1...9*

*cp /cib/inputdata/archives/modelE.scratch.tgz .*

*tar xfz modelE.scratch.tgz*

*cd modelE.scratch*

*cp /cib/models/archives/modele_env.bash .*

*. ./modele_env.bash*

*./setupmodelE* ← This script will copy modelE and generate .modelErc


# CIB hands on

*ls modelE*

*aux config decks E2000 init_cond model README tests*

*cmor CVS doc exec Makefile prtdag templates*

Open up ~/*.modelErc* with your favorite editor

# CIB hands on

*cd modelE/decks*

*cp /cib/models/archives/modele_run.j .* ← Note the space followed by a dot


# CIB hands on

*cd modelE/decks*

*cp /cib/models/archives/modele_run.j .*

- Edit modele_run.j: change X to number from 1...9

# CIB hands on

*cd modelE/decks*

*cp /cib/models/archives/modele_run.j .*

- Edit modele_run.j: change X to number from 1...9
- When done **submit** the "job" to the batch system. To **submit** the job we use the "qsub" command:

  *qsub  modele_run.j*

- You can monitor the job via the "qstat" command:

  *qstat*

# CIB hands on

- Results will be in out directory. So

  *cd /cib/outputdata/guestX/modelE.scratch/out/E1M20test*

  Open up file *E1M20test.PRT*, look at bottom for:

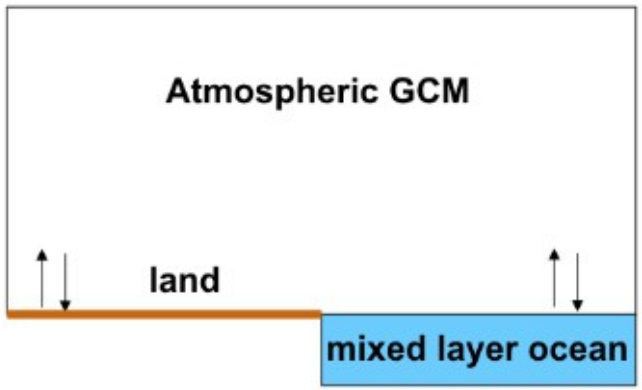
  *>> Terminated normally (reached maximum time) <<*

- Output can be viewed with GrADS or Panoply (both installed on CIB system).


Questions?

# A climate sensitivity experiment

- Ref: http://modelingguru.nasa.gov/docs/DOC-1757
- Set up a 2x$CO_2$ sensitivity experiment using E4M20
  - Restoring run
  - Q-flux adjusted Control run
  - 2x$CO_2$ perturbation run




$$\rho c_p h \frac{\partial T}{\partial t} = S_{\downarrow}(1-\alpha) + F_{\downarrow} - F_{\uparrow} - SH - LH$$

# References

- Configurations for AR4 Simulations:
  - GISS-ER: ModelE20/Russell 4×5×L20 (This corresponds to the rundeck E1aoM20.R)
  - GISS-EH: ModelE20/HYCOM 4×5×L20
    - Sun, S., and R. Bleck, 2006: Multi-century simulations With the coupled GISS-HYCOM climate model: Control experiments. Clim. Dyn. 26, 407-428. DOI 10.1007/s00382-005-0091-7
  - GISS-AOM: (C4×3)
- Model documentation, including the ModelE specification and results from three standard configurations, is given in the following journal article:
  - Schmidt, G.A., et. al. 2006. Present day atmospheric simulations using GISS ModelE: Comparison to in-situ, satellite and reanalysis data. J. Climate 19, 153-192.